FAO Plant Protection Bulletin

VOL. V, No. 11 — A Publication of the — AUGUST 1957

World Reporting Service on Plant Diseases and Pests

The Swollen Shoot Phase of the Virus Disease of Cacao in Ceylon

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A virus disease of cacao was described in Ceylon in 1953 by PEIRIS (2). The disease was characterized by vein flecking in leaves or vein clearing of the lower order veins which in the chronic phase may develop into the typical oak leaf pattern described by POSNETTE (3) for strains of the swollen shoot virus in West Africa. Although in Ceylon the leaf symptoms of the disease are similar to those caused by the swollen shoot virus, no swelling of the stem or root was observed nor was the vigor of affected trees markedly reduced. CARTER (1) observed the rounded pod symptom once in Ceylon but not stem swelling. The cacao virus of Ceylon was therefore thought to be caused by a strain of the swollen shoot virus, different in virulence from the virus complex in West Africa and characterized by the absence of swelling on stems.

In February 1957, stem swelling was observed by the senior writer on established cacao trees at the Kundasale Cacao Research Station at Kandy. These trees also showed leaf symptoms of vein flecking and oak leaf pattern. Since then the swollen shoot symptom has been noticed on several other occasions.

After the initial finding, a report was received that swelling was present on a bud graft at the Pallekelly Estate at Kandy. This report was confirmed by a visit to the estate, which revealed 15 bud grafts about one to two years of age in five budwood gardens showing stem swelling.

A tree-to-tree survey of the Pallekelly area disclosed swollen shoot symptom on over 300 seedling trees of 20 to 30 years of age. It is significant that all trees with such symptom also showed vein clearing on leaves. In one case swelling of the main root was observed (Figure 1, C). Rounded pods, however, have so far not been noticed by the writers in Ceylon, although they occur commonly in West Africa on trees infected by swollen shoot.

Stem swelling has been observed thus far only sporadically on seedling trees, either on plagiotrophic (fan) or orthotrophic (chupon) branches (Figure 1, A and B). One or more swellings may occur on a fan branch, but on chupons only one portion of the stem is generally hypertrophied. Swelling has been found so far only in growths less than three years old, except in one case where a branch about three years of age was seen with swelling. The swellings observed were nodal or internodal, whereas terminal swelling as described in West Africa by POSNETTE (3) has not been noticed. In some cases, the apical bud on the swollen shoot was killed following the premature senescence and leaf fall; in other cases the apical bud remained growing, or if killed, growth was continued by a lateral bud.

On one-to-two-year-old seedlings budded with scions from high-yielding mother trees from the Pallekelly Estate, the scions gener-

[1] The senior writer served as FAO Plant Pathologist assigned to Ceylon under the Expanded Technical Assistance Program during the period from July 1956 to June 1957. The writers are grateful to Messrs. D. CURRIE and J.K. GHANARATNAM, Manager and Assistant Manager respectively of the Pallekelly Estate, for their co-operation in this work, and to Dr. P. SURANY of the South Pacific Commission and Mr. M.B. DISSANAYAKE of the Division of Plant Pathology for photographs included here.

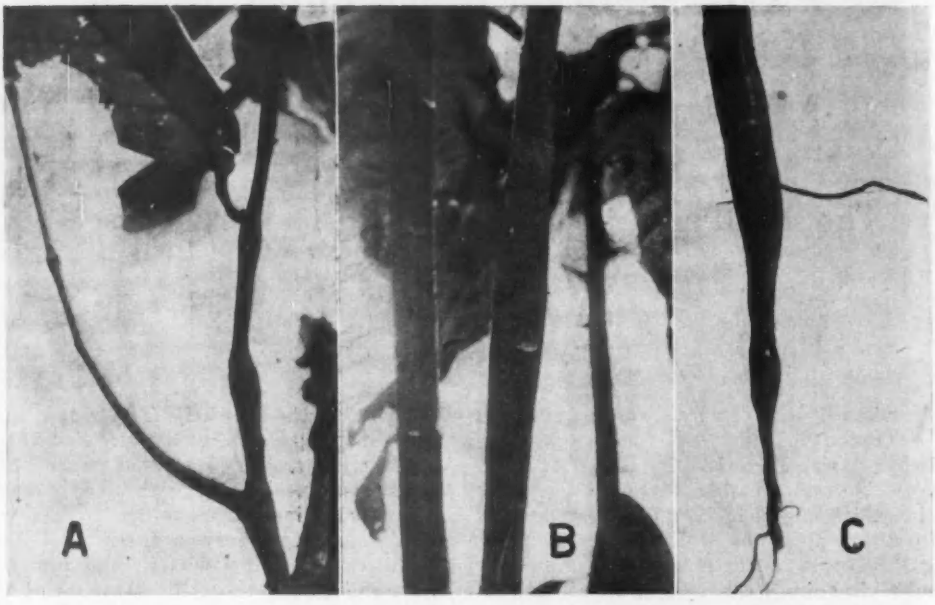

Figure 1. Swollen shoot symptom of the cacao virus disease in Ceylon. A. Two swellings on a fan branch of cacao. B. Swelling on a chupon branch of cacao. C. Swelling on a tap root of cacao.

ally showed swelling. In a few instances, particularly when the scions died, the branches of the stock manifested hypertrophy. In all cases the mother trees from which scions were taken, however, showed no swelling but only leaf symptoms in varying degrees. Their canopy was affected by mild or severe dieback and one tree severely affected by dieback was dying.

Thus far, rooted cuttings originating from trees from the Pallekelly Estate have not shown symptoms other than vein clearing in leaves. Similarly, five-to-six-month-old rooted cuttings from a Kundasale mother tree No. 101 which was affected by vein clearing for the last five years have not shown stem swelling.

In cross section, a swollen stem may show brownish discoloration involving the phloem and sometimes also adjacent tissues. A similar discoloration occurs in the pulvinal areas of petioles of leaves with vein-clearing symptom, regardless of the presence or absence of the swollen shoot phase of the disease.

Examination of the swellings on the stems failed to reveal the presence of any causal agents, such as insects, mites, etc. Although transmission tests are yet to be made, the fact that swollen shoots have been found only on trees showing leaf symptoms analogous to those of the swollen shoot in West Africa, leaves little doubt that the virus found in Ceylon is somewhat related to the swollen shoot virus strain 1A (or New Juaben strain). Strain 1A is the most virulent of the strains isolated in West Africa and it is found at the epicenter of the already devastated area at Koforidua, Ghana.

As it occurs now in Ceylon, the cacao virus disease presents two phases in its development; namely, the leaf symptom phase and the swollen shoot phase. The leaf symptom varies from the prevalent zigzag or oak leaf pattern of vein clearing to the less common vein-flecky pattern (Figure 2). As shown in Figure 3, the zigzag or oak leaf pattern is obviously the less severe form than the vein flecking. The variation of symptoms suggests the possi-

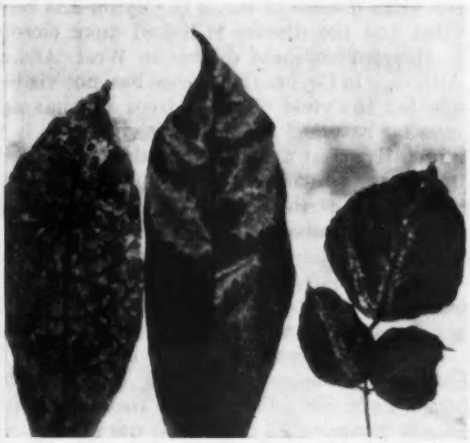

Figure 2. Variation in leaf symptoms of the virus disease of cacao in Ceylon. Left, a cacao leaf showing the vein-flecking symptom; center, a cacao leaf showing vein clearing of the zigzag or oak leaf pattern; right, a dadap (*Erythrina lithosperma*) leaf showing vein clearing which may be caused by the same virus.

bility of more than one form of the virus in existence in Ceylon. From present observations it appears that the vein-clearing virus may have mutated into a more virulent strain capable of causing swollen shoot similar to the virus strains in West Africa.

The possibility of intermediate hosts of the virus existing in Ceylon, as postulated by PEIRIS (2) in the case of dadap (*Erythrina lithosperma*), was examined by checking the plants introduced into Ceylon from West Africa and planted at the Botanical Gardens at Peradeniya. Among these plants, only one species of cola (*Cola acuminata*), which was introduced long ago, is known to be a host of the swollen shoot virus. The cola tree at Peradeniya had no apparent symptoms of virus infection, although it had galls and a stem swelling of possible insect origin.

Approximately 25 plant species have been introduced to the Botanical Gardens from South and West Africa since 1938. Of these, seven species of *Erythrina* (*E. mucropteryx*, *E. umbrosa*, *E. caffra*, *E. lystemon*, *E. constantiana*, *E. lithosperma* and *E. seylery*), two species of *Ceiba* (*C. pentandra* and *C. burchellii*), one *Gliricidia* (*G. maculata*), one *Albizzia* (*A. fastigiata*) and one *Artho-carpus* (*A. heterophilla*) are generally found in cacao plantations but none of them had virus symptoms. However, it should be

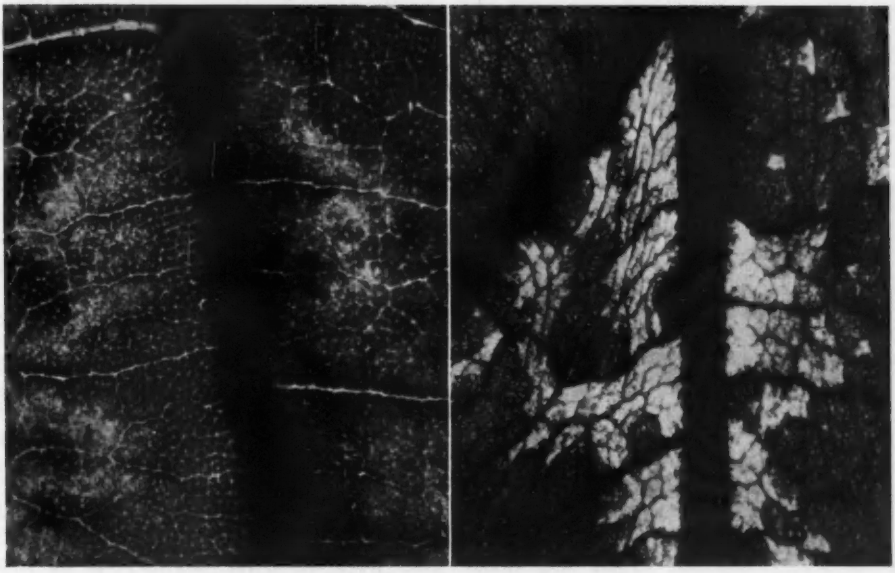

Figure 3. Portions of cacao leaves magnified to show the two different types of leaf symptoms. A. Zigzag or oak leaf pattern of vein clearing. B. Vein-flecking type.

noted that *E. lithosperma*, found in cacao plantations in the Kundasale-Pallekelly, as reported by PEIRIS (2), was affected by vein clearing (Figure 2), which may be caused by the same virus affecting cacao. According to TINSLEY and WHARTON (4), only plants in the order Tiliales are susceptible to experimental infection by viruses found infecting cacao in West Africa.

With the discovery of the swollen shoot phase, the gap in the symptomatology of the virus disease of cacao in Ceylon has been filled and the disease is linked more closely to the swollen shoot disease in West Africa. Although in Ceylon the disease has not visibly affected the yield of cacao trees and has not thus far assumed an alarming virulence, it is imperative that measures be taken to prevent its further spread and that intensive investigations be carried out to clarify the many problems involved.

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Wheat Stink Bugs in Morocco

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THE stink bugs affecting wheat, including the species *Eurygaster integriceps* known as sunn pest in the Near East, have received increased interest through the technical meetings convened recently by FAO and other agencies. However, the Near East is not the only region in which crops suffer from attacks of stink bugs. Certain countries in the western Mediterranean basin are also heavily infested by this group of insects. The insect species involved are not the same as those in the Near East. Their injuries are of different nature and their outbreaks do not occur at such regular intervals but they are not less important, especially in Morocco where the wheat stink bugs should be considered as one of the major pests.

In Morocco the presence of these insects was noticed only after the cultivation of soft wheat was extended, because it is on soft wheat that the injuries of the insects are most distinctive. An important outbreak occurred during 1933-34 and another during 1944-47. The present outbreak began in 1953.

Species Involved

The wheat stink bugs in Morocco belong to the species *Eurygaster austriaca* Schrk., *Aelia germari* Küst., *A. cognata* Fieb. and *Dolycoris numidicus* Horv. The first three species live either in association or separately in spots of variable sizes. *Dolycoris numidicus* is less important and so far has caused damage only in the high valley of Moulouya, at Itzer and Tounfite.

The identity of the North African species of *Aelia* has been the subject of much discussion and the systematics of this genus is not yet entirely clear. Specimens from Morocco were studied by BERGEVIN, CHINA, RIBAUT and VIDAL, and they had been successively named as *A. cognata*, *A. triticiperda* and *A. germari*. In accordance with the studies carried out at the Entomological Laboratory of Meknès, the *Aelia* of Morocco are at present regarded as belonging to two species, *A. germari* and *A. cognata*, the first being more abundant on the plains and the second in the mountains.

Whereas their classification is not well established, the life history, ecology, and the question of migration of wheat stink bugs also remain rather obscure.

Biology

Eurygaster austriaca invades the cereal field on the plains and the valleys in March. Eggs are laid during April, larvae develop from May to June and adults appear at the end of June. At the first appearance of hot wind the insects leave the cereal fields but it is not known where they go.

Aelia species appear in the field at the same time as *Eurygaster* and their early life history is also the same, i. e. oviposition in April, larval development in May and June, first adults at the end of June, but they have a second generation during which the larvae develop in July. The larvae feed on quack grass and wheat grains left in the fields, and they hide under shocks and straws. Adults of the second generation, which develop wings at the end of July or the beginning of August, disappear soon but their destination is unknown. Both *Eurygaster* and *Aelia* are easily bred from July until March of the next year in an insectarium where they seek shelter under straws, leaves or grasses and emerge at the end of winter.

Migration

The migration of these insects has received a great deal of study. From July 1956 to March 1957 the Riff mountains, the Middle Atlas mountains, the forests of Mamora and Zaers and the valley of upper Moulouya have been searched. Scattered insects were found here and there under fallen

leaves in the eucalyptus forest of Rharb; under *Retama sphaerocarpa* at Midelt; under *Helianthemum*, bushes and stones at Ifrane; under *Artemisia herba-alba* at Boulmane. But the insects were not found in sufficient numbers to suggest that these were hibernating places.

Damage

The damage that the wheat stink bugs cause in Morocco are different from those in the Near East, where they attack stems and heads of cereals before the formation of grains, causing plants to wilt. Damage to the grain is therefore not frequent, nor has it yet been evaluated, as stated at the FAO meeting held at Ankara in 1956. In Morocco, with the exception of the damage caused by *Dolycoris* which attacks the heads at the flowering stage, the only damage caused by stink bugs occurs on the grain. It may happen that grains are severely injured and reduced in weight, resulting in a quantitative loss of the crop, but this is rather unusual. More often the losses concern the quality of the grain. Such losses can be evaluated after harvest by grain analysis and determination of gluten. But even a simple examination of the grains after threshing is often not sufficient to indicate the extent of the deterioration of the crop, mainly because only 2 percent of affected grains would be enough to render a whole batch of flour unsuitable for baking. For this reason it is very difficult to evaluate the losses caused by these insects.

The wheat stink bugs, while feeding, inject into the grain a proteolytic saliva which dissolves the proteins, and consequently part of the gluten in the grain is lost. At the point of puncture the grain loses its amber color, becomes white and depressed. In making bread the flour forms an inconsistent, stringy dough lacking cohesion. When baked, the dough may rise, but collapses later, producing a flat bread of poor quality. In laboratory tests with the extensometer, it could be observed that the dough from injured grains had lost tenacity and elasticity. These two factors together with extensibility determine the baking quality of flour. They all depend on the gluten content and are expressed by index W. In Morocco the common wheat varieties, such as Florence x Aurore and Pusa, may attain a W index of 250 if not infested, but infested grain of such varieties gives only a W index of 100 or even less.

Natural Enemies

The natural enemies of wheat stink bugs in Morocco are the same species as found in the Near East, or their close relatives: a hymenopterous egg parasite *Microphanurus perresi* Kieffer and Phasiid flies as *Gymnosoma rotundatum* L., *Clytiomyia helluo* Fabr. and *Helomyia lateralis* Meig., the larvae of which parasitize the adult bugs. Among these, *M. perresi* is of particular importance; it was observed in 1933 that its parasitic action had prevented the hatching of eggs over thousands of hectares, where up to 50,000 eggs were found per square meter.

Control Measures

There are not yet satisfactory methods for the control of wheat stink bugs. As in the Near East, collection of the insects by hand and the use of synthetic insecticides have been tried.

The collection of insects was undertaken in 1934 and during that year this measure was even compulsory in many localities. The same method was applied again methodically in 1955. The costs per hectare involved were very variable, in some cases being approximately equivalent to the value of 50 kilograms of wheat. The handicap to this measure is not the cost but the difficulties in practice. The wheat stink bugs are found only in small spots frequently less than one hectare in size. Those spots must be detected by inspection, which is difficult to carry out due in large measure to the inertia of the farmers and the density of vegetation. In April, when inspection takes place, it is difficult to walk through the fields of early maturing soft wheat which has formed heads and which have been sown very densely. Furthermore, the value of such operations is always uncertain. The escaping insects may disappear and after the harvest damaged grains may be found in fields where the insects have been collected.

For chemical control, synthetic insecticides, chlorinated hydrocarbons and organic

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phosphates, have been used. The results of laboratory tests which still have to be confirmed show that parathion is effective at a very low dosage. Field experiments with organic phosphates and BHC applied by aircraft and ground equipment gave inconclusive results. Portable dusters which have been successful elsewhere are difficult to use in densely sown wheat fields. Heavy power dusters capable of spreading the dust over 100 meters on bare land, cover only a few meters in wheat fields and therefore must be moved close to the plants, thus injuring them. As the wheat stink bugs are concentrated in small spots much insecticide applied by aircraft is wasted.

In connection with indirect control methods, it has been observed that *Eurygaster austriaca* prefers to feed on wild grasses, especially *Phallaris*, rather than on wheat. The cultivation of these grasses in wheat fields as traps will be studied.

In practice the best method for protecting wheat is the cultivation of early maturing varieties and early harvest. The soft wheat grown in Morocco are early varieties chosen for the purpose of avoiding the hot dry winds in the spring. Harvesting is done quickly by combines but it will be necessary to accelerate it even more.

It is planned to test the possibility of controlling wheat stink bugs in Morocco by the biological method which is being studied in Iran. Either *Microphanurus perresi* or introduced parasitic species will be used for this purpose.

Conclusions

The problem of wheat stink bugs in Morocco is essentially the same as in the Near East.

The importance of these insects has not been fully recognized and their outbreak must be considered as a plague.

The known control methods are inadequate. Collecting insects by hand is often difficult in practice and its value is questionable. Chemical control, without considering the costs involved, is also difficult to apply because of the nature of wheat fields and the distribution of the insects in the fields. A trial on biological control based on the methods used in Iran is under way.

Efficient control methods can be developed only on the basis of an adequate knowledge of the ecology, histology and physiology of the wheat stink bugs. Investigations along these lines are under way and will be intensified.

Diseases of Warm Climate Crops in Bolivia

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BECAUSE Bolivia is principally known for its tin, and since most of the population lives in the highlands, it is not generally realized that 70 percent of the country is composed of tropical and semitropical lowlands.

Santa Cruz is the center of an area which is rapidly being developed and is hailed as the land of agricultural future in the country. Transportation facilities, the lack of which is the common impediment to the development of such inland areas, have been greatly improved, permitting a recent increase in agricultural activities. One railroad now connects Santa Cruz with Brazil, another is approaching from Argentina, and a modern paved road is being completed to Cochabamba which will connect the area with the country's centers of population.

The Servicio Agrícola Interamericano operates two experiment stations in the lowlands, one north of Santa Cruz, and one in Riberalta. Extension agents of the same organization are located in principal agricultural areas.

Citrus

The most destructive disease in the country as a whole is gummosis (*Phytophthora* sp.). In some localities in eastern Bolivia where there is high rainfall or poor drainage, or both, the disease prohibits the growing of citrus as an economic crop. It is of little importance in the hot valleys of La Paz called Yungas, because of the mountainous terrain and resultant good drainage. Until recently, grafting of citrus was seldom practiced in the country. Some farmers are beginning to use sour orange rootstocks, but this has been discouraged because of the tristeza threat.

In the Sud Yungas of La Paz, and to a lesser extent in some other citrus-growing areas, a fruit and leaf spot caused by a species of *Septoria*, regarded by J.A. STEVENSON as apparently undescribed, often badly marks the appearance of the fruit of orange and grapefruit. In the eastern lowlands, sweet orange scab (*Elsinoe australis*) causes the same type of damage. Sour orange scab (*Elsinoe fawcettii*) is frequent wherever the host is grown. Sooty mold (*Capnodium citri*), felt (*Septobasidium* sp.), and anthracnose (*Colletotrichum gloeosporioides*) are widespread. Exocortis is present on some nursery trees grafted on trifoliate orange in the Sud Yungas of La Paz.

Coffee

Brown eye leaf spot (*Cercospora coffeicola*) is the most widely distributed of the major diseases, and is damaging in the relatively important coffee producing Yungas of La Paz. However, *Colletotrichum coffeanum* may cause part of the damage attributed to the *Cercospora* fungus, because the two fungi have been collected together and dieback is often a symptom. American leaf spot (*Mycena citricolor* = *Omphalia flavida*) is locally abundant in various regions of high humidity. The thread blight disease (*Pellicularia koleroga*) occurs on coffee growing in a humid ravine near Santiago de Chiquitos, Department of Santa Cruz. *Mycosphaerella* sp. and *Septoria berkeleyi* have been collected in the La Paz Yungas.

Avocado

A wilt of avocado has been observed in various parts of Bolivia, including the Santa Cruz region, the Sud Yungas of La Paz, and the Chapare Province of the Department of Cochabamba. It is most severe in the latter area, which lies against the Andes mountains and consequently has a very high rainfall.

[1] The authors acknowledge the assistance of J.A. STEVENSON, E.K. CASH, P.L. LENTZ, and A.L. ROBERTS, of the Agricultural Research Service, United States Department of Agriculture, who identified many of the fungi discussed in this report.

Phytophthora cinnamomi has recently been isolated from the roots of dying trees from Chapare, and it is therefore assumed that this fungus is the usual cause of the disease in Bolivia.

Other fungi collected from avocado are *Cercospora purpurea*, the cause of a leaf spot in the Sud Yungas of La Paz, *Colletotrichum gloeosporioides*, the cause of fruit rot in Santa Cruz, *Stilbella* sp. (probably a secondary parasite) from the died-back branches of a tree with anthracnose near Santa Cruz, and *Phyllachora gratissima* from the Yungas of La Paz and Cochabamba.

Cacao

Witches broom (*Marasmius perniciosus*) is apparently present wherever cacao is grown, as it has been noted in the Santa Cruz area, the Chapare region of the Department of Cochabamba, and the Department of Beni. Pod rots are common wherever cacao is grown. *Diplodia theobromae* and *Colletotrichum* sp. have been found on diseased pods, but it is not known what fungus causes the greatest damage.

Other Crops

Smut (*Ustilago scitaminea*) appears to be the only disease of sugar cane that is of major importance, although little is known of the viruses, of which a mosaic has been noted. Fortunately, smut is confined to the Rio Chico region of the Department of Chuquisaca. *Leptospheria sacchari* and *Melanconium sacchari* have been collected in the Santa Cruz area, and *Colletotrichum falcatum* is apparently present, although spores have not been found.

Rice false smut (*Ustilaginoidea virens*) is established in several fields north and west of Portachuelo, Department of Santa Cruz, where it is causing considerable concern to the farmers. It was apparently brought in recently on seed from Brazil. An eradication program was initiated on one farm, when it was thought to be the only center of infection. However, when other centers were reported, it was considered impractical, in view of the technical level of farming in the area.

Cercospora cruenta has been collected on velvet bean, and a mosaic has been noted on the same host. *Cercospora arachidicola* has been found on peanut.

South American leaf blight (*Dothidella ulei*) is important on hevea rubber in northern Bolivia. Black crust (*Catacauma huberi*) is also common.

Papaya is commonly attacked by *Asperisporium caricae*. *Cercospora henningsii* is found on yuca. *Pellicularia filamentosa* causes a common leaf spot of the small plantings of kenaf in Santa Cruz and Riberalta. *Colletotrichum camelliae* has been collected on tea in the La Paz Yungas.

Plant Disease Situation in the United States [1]

COMPILED BY PAUL R. MILLER

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Summer Dwarf Nematode Disease of Strawberry in Arkansas

SUMMER dwarf of strawberry, caused by *Aphelenchoides besseyi*, is known to occur mainly in the southern United States. Its recent occurrences in Arkansas have been reported by D.A. SLACK, C. SEYMOUR, H. FIELDS and J.P. FULTON.[2] According to these authors, the disease was observed in 1954 in strawberry plantings set from inspected plants of the Blakemore variety and, in many instances, on land not planted to strawberries previously. Symptom expression was most pronounced after mid-September but became difficult to recognize after the middle of December when plants became partially dormant.

In the early part of the 1955 season, plants that had been diseased in 1954 appeared to have recovered. In some affected areas, there was some reduction in yield and more misshapen fruit than usual. In August, however, the disease reappeared and had spread to a larger number of plants in the affected fields. The identity of the disease was confirmed by examining the diseased plants in the laboratory, from which the nematode had been recovered. Such plants transplanted in the greenhouse developed symptoms typical of summer dwarf. Leaf petioles of new growth were short, thickened and reddish in color. Leaflets were narrow in proportion to length and severely distorted and crinkled. In addition, phyllody of flowers developed in some diseased plants and the fruit produced was malformed.

The symptoms in some respects resembled those attributed to the aster yellows virus in strawberry, but summer dwarf was not lethal and affected plants did not show the severe chlorosis and adventitious crown development associated with the aster yellows virus.

In the field, plants affected by summer dwarf were characterized by outspread older leaves frequently showing an upward curling of leaflets. New leaves were dwarfed, chlorotic and somewhat twisted (Figure 1). A slight crimping effect was apparent on a few younger leaflets, but leaflet malformation was slight as compared with earlier descriptions given by other authors in this respect. The Blakemore variety, which was planted on about 87 percent of the acreage grown for strawberry plant production in Arkansas, was most commonly affected.

In an effort to eliminate summer dwarf, strawberry fields grown for plants were inspected from 15 September through November. In questionable fields, a minimum sample of 50 plants per acre was taken from at least 15 locations and sent to the laboratory for determination. In the laboratory the bud was removed from each plant, macerated separately in a Syracuse watch glass and covered with distilled water. After one or two hours the buds were examined under a stereoscopic microscope. From diseased plants not heavily infested, each bud usually yielded from 10 to 30 specimens, which were checked for species determination. Strawberry fields were quarantined or released for plant production according to the results of laboratory diagnosis.

Heat and drought during the growing seasons from 1951-52 through 1955-56 greatly reduced the quantity of Arkansas-grown strawberry plants available to growers, and consequently plants were purchased from various sources to meet the shortage and to introduce new varieties, and labeled "virus-free." These introductions apparently brought the nematodes with them. Examination of the sources of strawberry plants set

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[1] This report is based upon material submitted by Collaborators of the Plant Disease Epidemics and Identification Section, Agricultural Research Service, United States Department of Agriculture.

[2] SLACK, D.A. C. SEYMOUR, H. FIELDS and J.P. FULTON. 1957. Summer dwarf of strawberry. *Plant Dis. Reptr.* *41*: 398-401.

Figure 1. Strawberry plant infected with summer dwarf in the field, showing the upward curling of leaflets and the chlorotic, dwarfed and twisted new leaves.

in fields that developed summer dwarf revealed that infected plants during the 1955-56 season primarily originated from Arkansas, and those during the 1954-55 season appeared to have originated from Arkansas, Tennessee, Oklahoma, Missouri and Maryland. Diseased plants found in four fields during the autumn of 1956 came from Tennessee and Arkansas.

The authors conclude that although summer dwarf of strawberry has been of little importance in southern strawberry-growing areas since 1940, it could assume a more serious status if proper attention is not given to the strawberry plant production program. Several factors have probably influenced symptom expression in recent years, including the relatively low populations of the nematode recovered from diseased buds, retardation of plant growth, and disease development due to dry, hot weather during mid-season, and the sudden resumption of plant growth and disease development during autumn. The aberrant behavior of the disease sometimes makes diagnosis from field symptoms alone difficult or impossible, and therefore field diagnosis should be supplemented by laboratory analysis.

With the increased emphasis on development and planting of " virus-free " strawberry varieties, other disease problems such as summer dwarf are easily overlooked or ignored. From their experience with this nematode disease, the authors consider that the development of a disease-free strawberry program, as opposed to a " virus-free " program, would have merit.

Outbreaks and New Records

Costa Rica

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Current Situation of Mediterranean Fruit Fly

THE Mediterranean fruit fly (*Ceratitis capitata*) was discovered in Costa Rica in March 1955 in the Province of San José and it has since then been a matter of great concern to all countries in Central America. At the fourth meeting of the Comité Internacional Regional de Sanidad Agropecuaria (CIRSA), it was therefore resolved that the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) organize an all-out campaign for eradication of this pest. A special expenditure was appropriated for this purpose. The Inter-American Institute of Agricultural Sciences has also indicated its willingness to co-operate. In order to prepare for this campaign, which is to be initiated in July 1957, Ing. José de J. Castro, Executive Director of OIRSA, and the writer, carried out a general survey in all known infested areas in Costa Rica during late May and early June of this year.

The survey was begun on the central plateau, the entire area of which is known to be infested by the Mediterranean fruit fly. In the citrus groves where spraying operations have been carried out, the adult fly population was found to be relatively low. However, control operations were confined to the large citrus groves, without covering backyard properties, coffee plantations and all wild hosts. Therefore, there is a constant supply of adult flies, not only for reinfesting the treated citrus groves but capable of extending their range beyond the central plateau.

The area between San José and Puntarenas was surveyed next. It is along this road that infested fruit from the San José market is transported to Puntarenas, a large seaport on the Gulf of Nicoya. All traps located in the area were examined, but not a single specimen of the Mediterranean fruit fly was found, although many specimens of the genus *Anastrepha* were present. In addition, fruits of many favored host plants were inspected, but the only species of fruit fly found was *Anastrepha mombinpraeoptans* in hog plums of the genus *Spondias*. In view of the fact that only a few specimens of the Mediterranean fruit fly had been trapped in this area in the past and that a considerable interval has elapsed since the last specimens were found, the fly may no longer exist in this area, or otherwise, the adult population must be at a very low level, making eradication of the pest a hopeful proposition.

The last area covered by the survey was in the Turrialba region, where the coffee experimental plots at the Inter-American Institute of Agricultural Sciences and a coffee plantation regarded as the largest and the most important in the region were examined. Ripe coffee berries in both places were found to be heavily and extensively infested by the larvae of the Mediterranean fruit fly. In the plantation, there were also a large number of sweet orange trees loaded with ripe fruit, but examination of dropped fruit failed to reveal the presence of Mediterranean fruit fly larvae. Therefore, the situation in the Turrialba region is almost exactly the reverse of that found on the central plateau, where oranges and mandarines are heavily infested by the fly, with mango being the next preferred host. In the Turrialba region, ripe coffee berries are the preferred food, with oranges remaining virtually unattacked by the fly. Due to the type of terrain present, the task of carrying out eradication measures

in the Turrialba region will be much more difficult than that on the central plateau. However, the owners of various coffee plantations have indicated their desire to cooperate in the campaign which may be greatly strengthened by the combined efforts.

Present available information indicates that the Mediterranean fruit fly has not appreciably extended its range in Costa Rica during the past two years. Despite the many difficulties involved, its eradication still seems possible.

Plant Quarantine Announcements

Cyprus

The Importation of Produce (Control) Order of 10 June 1957 revokes the Importation of Plants Order No. 1421 of 1931 as amended, the Importation of Cotton Order No. 1754 of 1937, the Importation of Seed Potatoes Order No. 1305 of 1929 as amended, section 5 of the Custom (Prohibition and Restriction of Imports) Order of 1936, Order-in-Council No. 1930 of 1940, and the Prevention of Importation on Fodder-packing Order of 1926.

Importation Prohibited

1. Potato tubers and any other part of potato plant except seed potatoes.
2. Plants, fruit and peels of all members of the subfamilies Aurantoideae, Rutoidae and Toddalioideae of Rutaceae; plants, fruits of all members of the genus *Vitis* excluding dry currants and raisins. Seeds and processed peels of fruits are excluded from prohibition.
3. Raw vegetables.
4. Cut flowers.
5. Soil and gravel, leaf and garden mould, including soil present with imported plants, seeds or vehicles.
6. Fungi including mushrooms, live insects including bees, cultures of bacteria or other organisms capable of attacking plants or animals.
7. All animal or vegetable manures, except peat moss, guano, bone dust, other fossil or chemically prepared manures.
8. Swill.
9. Walnuts, almonds, hazelnuts and groundnuts in shell.

Certification

Each consignment of plants and fruit destined for importation should be accompanied by a phytosanitary certificate issued by a competent government agency of the country of origin in the prescribed form which is similar to that annexed to the International Plant Protection Convention. The inspection referred to in the certificate must be carried out not more than ten days prior to dispatch of the consignment. Where the certificate is in a language other than English, an English translation should be included.

A certificate is also required for consignments of seed potatoes, broom corn beard, seeds of lettuce, tomato, peas, haricot beans and lucerne, shelled groundnuts and chestnuts. The certificate should contain additional declaration in regard to the disease or other requirement specifically mentioned for each of these commodities,

Importation of Plants

The importation of plants (referring to all living plants and parts thereof, but excluding fruit, raw vegetables, seed, potatoes, cotton, cut flowers) is permitted only if:

a) they originate and are imported directly from the United Kingdom, Ireland, Belgium, Denmark, the Netherlands, Norway and Sweden (plants from any other country which has endorsed the International Plant Protection Convention may be imported if prior permission has been obtained from the Director of Agriculture);
b) they have been examined during the preceeding growing season and found to be substantially free from injurious pests and diseases including virus diseases;
c) they have been grown at least 2 kilometers from any place where potato wart (*Synchytrium endobioticum*) has

occurred during the preceeding ten years; and

d) they have been grown in a place, within 25 kilometers from which Colorado beetle (*Leptinotarsa decemlineata*) is not known to be established.

For the importation of plants enumerated below, it is also required that they have been grown at least 20 kilometers from any place where San José scale (*Quadraspidictus perniciosus*) has occurred during the preceeding two years, or that they have been fumigated with hydrocianic acid gas (5 grams per cubic meter; 30 minutes; 7° C.) or with methyl bromide if authorized by the Director of Agriculture.

Acacia spp.
Amelanchier spp.
Chaenomeles spp. (incl. *Cydonia japonica*)
Cotoneaster spp.
Crataegus spp.
Cydonia vulgaris
Fagus spp.
Juglans spp.
Maclura aurantiaca
Malus communis
Populus spp.
Prunus spp. (incl. *amygdalus, armeniaca, cerasus, laurocerasus, padus* and *persica*)
Ptelea trifoliata
Pyrus spp.
Ribes spp.
Rosa spp.
Salix spp.
Sorbus spp.
Symphoricarpus spp.
Syringa spp.
Tilia spp.
Ulmus spp.

Importation of Seed Potatoes

Seed potatoes may be imported only from such countries and in such quantities and grades as authorized beforehand in writing by the Director of Agriculture, through only the ports of Famagusta, Larnaca, Limassol or Paphos. They should be imported direct from the country of origin, and transshipment is permitted only if the potatoes remain in customs charge while at the port of transshipment. Each bag should not contain more than 50 kilograms of potatoes.

The crop producing the seed potatoes must have been grown in land which is free from potato root eelworm (*Heterodera rostochiensis*) and is located at least 2 kilometers from any place where potato wart or ring rot (*Corynebacterium sepedonicum*) has occurred at any time, and within 25 kilometers from which there has been no outbreak of Colorado beetle during the preceeding 12 months. The crop must also have been inspected while growing and found to be not less than 97 percent true to type.

The consignment must be found on arrival to contain not more than ½ percent by weight of tubers affected by late blight (*Phytophthora infestans*). If containing more than 10 percent of tubers with more than 10 percent of the surface affected by powdery scab (*Spongospora subterranea*) or common scab (*Actinomyces scabies*) the consignment will be subject to disinfection, treatment, destruction or re-exportation.

In addition to the phytosanitary certificate, every consignment must be accompanied by a statutory declaration by the shipper in prescribed form.

Importation of Seed and Other Produce

Broom corn beard. The non-bearded stalk must not exceed ½ centimeter in length and the consignment must have been fumigated in the country of origin with hydrocyanic acid gas (5 grams per cubic meter; 30 minutes; 7° C.).

Lettuce seed. The seed-producing crop must have been examined during the growing season by the plant protection service of the country of origin and found to be free from lettuce mosaic.

Tomato seed. The seed-producing crop must have been examined and found free from bacterial canker (*Corynebacterium michiganense*).

Dried peas. The growing crop must have been examined and found free from bacterial blight (*Pseudomonas pisi*).

Dry beans. The growing crop (*Phaseolus* spp.) must have been examined and found free from bean anthracnose (*Colletotrichum lindemuthianum*).

Shelled groundnuts and chestnuts. The consignment must have been fumigated and the particulars of the treatment must be indicated in the certificate.

Packing material. Hay, straw or other fodders may not be used for packing of imported merchandise unless such material has been grown and stored and the merchandise packed in a district free from foot and mouth disease, or the packing has been thoroughly disinfected. A certificate from a veterinary inspector in this regard is required, or the packing must be destroyed upon arrival.

Imports Requiring License

In addition to seed potatoes, the following produce may be imported only under license issued by the Director of Agriculture, subject to the terms and conditions prescribed therein.

a) Carobs.
b) Cotton (plants, any parts thereof, whether living or dead, including seed).

c) Fodder, hay and straw except as packing material.
d) Fresh fruit.
e) Hemp seed (*Cannabis sativa*).
f) Honey and uncooked substances containing honey.
g) Opium poppy seed (*Papaver somniferum*).
h) Packing material previously used for the transportation or storage of the above materials.
i) Plants from countries which have endorsed the International Plant Protection Convention, other than those from which the importation of plants is normally permitted.
j) Sunflower seed.
k) Sweepings.

Imports Permitted

The following produces be may imported without restriction, provided they are found on arrival to be free from injurious insects and diseases and cleaned from husks, straw and earth: cereals and all dry seeds except those specifically restricted; acorns; valonia; preserves; tamarind; crystalized fruits; dessicated vegetables; dried or frozen or bottled and canned fruits and vegetables; flour and meal of all kinds and preparations thereof; saponaria wood; dry and aromatic plants for medical purposes and dying.

Packing of Consignments

All imported produces must be completely enclosed in stout containers which should be clearly labelled and marked.

Exemptions

The Director of Agriculture may permit the importation of any plants or seeds which are otherwise prohibited or restricted and provide for their postentry quarantine. The Director may also issue license to permit the importation of any produce under conditions specified in the license, and may import any articles, goods or merchandise on behalf of the Government for experimental or scientific purpose.

News and Notes

International Nematology Symposium

The Fourth International Nematology Symposium, convened by the Society of European Nematologists, will take place in Hamburg, Germany, 5-7 September 1957, immediately preceding the Fourth International Congress of Crop Protection. The program will include four sessions dealing with taxonomic problems, stem eelworms, root knot nematodes and migratory root eelworms respectively, and also an excursion on the last day to visit tree nurseries. Further enquiries should be addressed to DR. H. GOFFART, Biologische Bundesanstalt, Münster, Westf, Grevenerstrasse 297, Germany.

European and Mediterranean Plant Protection Organization

Important changes in the administrative structure of the European and Mediterranean Plant Protection Organization (EPPO) were made at the seventh meeting of its Council, held at Marseilles on 10 April 1957. MR. H. VAN ORSHOVEN (Belgium), who had been the Chairman of EPPO Council since EPPO was formally established in 1951 (and was previously the Vice-Chairman of the International Colorado Beetle Committee) retired, and MR. R. BRACONNIER, Director-General of Agriculture in the French Ministry of Agriculture, was appointed Chairman in his place. MR. VAN ORSHOVEN was made Honorary President of that Organization. MR. R. PROTIN, previously Director of Agricultural Production in the French Ministry, who had been Vice-Chairman of EPPO Council since 1951, also retired, in view of his appointment as Director of the International Wine Office, and his place was filled by DR. H. DREES, Head of the Federal German Plant Protection Service. Certain vacancies on the EPPO Executive Committee, occurring through the retirement of members who had served the normal period of three years, were filled by representatives of other

governments. The Executive Committee now consists of the Chairman, Vice- Chairman, and representatives of Greece, Jersey, the Netherlands, Sweden and Yugoslavia.

A further report of the EPPO Working Party on Phytosanitary Regulations was approved by its Council for publication and distribution to governments.

A Conference will be held in Luxembourg on 23 July 1957 to consider the position arising from the spread of muskrat infestation in the Saar and along the Moselle to Luxembourg. The Governments of Belgium, Federal Republic of Germany, France, Luxembourg, the Netherlands and Switzerland have been invited to send representatives, and the possibility of co-ordinated control action will be explored.

The Danish and Swedish Governments have each contributed 10,000 DM. toward the cost of a special compaign in 1957 against the Colorado beetle in Schleswig-Holstein, in an effort to prevent the spread of the pest to Denmark.

EPPO, in collaboration with the Federal German Government, is organizing a refresher course for phytosanitary inspectors, which will be held in Munich from 21-26 October 1957. The course, which will be mainly practical in character, will deal with the inspection of produce from the standpoint of detection of San José scale, Mediterranean fruit fly, potato root eelworm, and the pests and diseases of flowers and flower bulbs.

A further meeting of the EPPO Working Party on pests and diseases of stored products will be convened in Copenhagen in the spring of 1958. The Working Party will deal with certain infestation problems of grain and other stored foods, including the control of infestation in ships, and will also discuss problems arising from the OEEC Stored Products Conference (11-13 June 1957) which may be referred to EPPO for more detailed consideration.

During 1958 it is also proposed to convene an international conference on rodent pests of field crops and of agricultural produce in store. Details will be announced later.

EPPO has decided to act as an intermediary between its member governments who wish to have plant propagating material tested for health but have not the necessary technical facilities, and governments who possess such facilities and are willing to place them at disposal on a " repayment of expenses " basis. If cases arise where the facilities could best be provided by countries outside Europe and the Mediterranean area, the help of FAO will be sought.

Under the sponsorship of EPPO, PROF. I. REICHERT of Israel and MR. P. FREZAL of Algeria will visit certain of the Mediterranean countries during 1957 to discuss co-ordination of effort in regard to citrus virus diseases and the Mediterranean fruit fly, following the recommendations made by the two EPPO conferences recently convened on these subjects.

The annual *Progress Report*, describing the activities of the Organization during the year 1956-57, has just been published. Copies can be obtained from EPPO: 142, avenue des Champs Elysées, Paris 8e.

Roma - Tip. del Senato del dott. Giovanni Bardi